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OBSERVATIONS ON SPHAEROSOMA AND ALLIED GENERA

FRED. J. SEAVER

(WITH PLATE 123, CONTAINING 10 FIGURES)

In response to a paper recently published on the genus *Lamprospora,*[1] the writer has received from Doctor Roland Thaxter a very interesting plant which it was suggested might belong to that genus, or, possibly, to the genus *Boudiera.* Examination of the spores and paraphyses of this plant, which was collected at Kittery Point, Maine, led the writer to suspect that it was very closely related to *Sphaerosoma echinulatum* of the writer.[2] In fact the spores and paraphyses scarcely differed from those of my own plant. A later examination of the entire plant showed considerable difference in the gross characters of the two, the Maine plant resembling in general appearance a *Lamprospora* rather than a *Sphaerosoma.* In spite of this fact, however, there was sufficient similarity between the two to suggest that they were, at least, very closely related.

The study of this plant has suggested a review of the facts regarding the identity of the genus *Sphaerosoma* and its relation to other genera of the discomycetes. Several papers have recently appeared on this subject, but there are still a number of points which are not entirely clear. Many of these questions will never be cleared up until the species of *Sphaerosoma* are collected in sufficient quantity to make a careful morphological study of the

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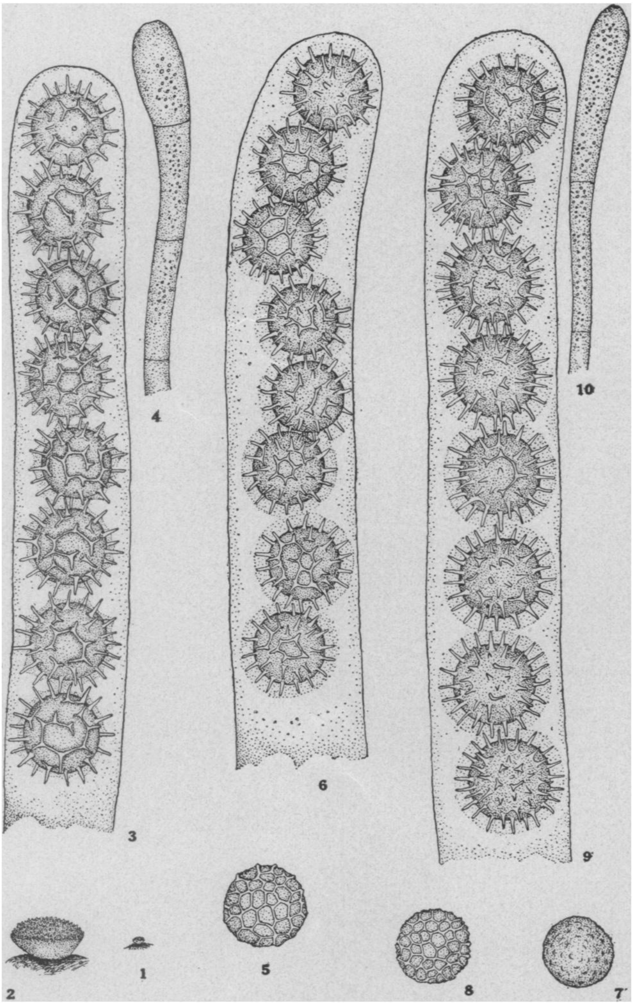
[1] MYCOLOGIA **6**: 5–24. *pl. 114.* 1914.

[2] Jour. Myc. 11: 2–6. *pl. 75.* 1905.

[MYCOLOGIA for March, 1914 (**6**: 49–102), was issued March 18, 1914].



BOUDIERA AREOLATA COOKE & PHILL.
SPHAEROSOMA ECHINULATUM SEAVER

genus and its relation to other genera. In the meantime, mycologists will continue to speculate on the probable relationship of *Sphaerosoma* to other genera, as best they can, with the limited knowledge based of the scant material which is available.

The genus *Sphaerosoma* was founded by Klotzsch on *S. fuscescens*. As pointed out by Professor Setchell,[3] there have been various interpretations as to the exact character of the spores of this species, some describing them as echinulate, others as reticulate, and still others as verrucose. Professor Setchell in assuming that the spores in *Sphaerosoma fuscescens* were echinulate has suggested that this type of plant be regarded as the true *Sphaerosoma* and has followed Hennings[4] in treating the reticulate-spored species in the separate genus *Ruhlandiella*. In describing his Californian species, it was therefore placed in the genus *Ruhlandiella* since the spores were reticulate.

The writer has recently examined a specimen of *Sphaerosoma fuscescens* collected in Germany by Klotzsch. While this specimen is not actually marked type, we have reason to believe that it is a part of the type collection. At least, it is probably as authentic as any material that can be had. The spores of this plant are deeply areolate or reticulate, the ridges of the areolae extending two or three microns beyond the periphery of the spore and often appearing as short spines. The spore characters of this plant are very similar to those of *Ruhlandiella hesperia* Setchell, a specimen of the type of this latter species having been examined by the writer through the kindness of Professor Setchell. From the nature of the spores, it is not difficult to account for the description of the spores as both reticulate and echinulate.

It is not even difficult to understand how the spores might have been described as verrucose when we recall that most of the reticulate-spored discomycetes were originally described with verrucose spores. *Peziza Crouani* was so described by Phillips and *Peziza aurantia* has been repeatedly described and illustrated with verrucose spores, although both species have spores which are distinctly reticulate. Even with the microscopes used at the present time, it is often difficult to make out the exact nature of the spore markings in some of these species, and they may even be interpreted differently by different observers. It is possible, however, as suggested by Professor Setchell that Corda[5] had the wrong plant.

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[3] Univ. Calif. Pub. 4: 107–118. *pl. 15.* 1910.

[4] Hedwigia 42: (22). 1903.

Whatever view we accept with reference to Corda's illustration and the accompanying description, the fact remains that Klotzsch's plant examined by the writer shows the spores to be reticulate, and I am therefore compelled to agree with Roupert[6] as to the character of the spores in *Sphaerosoma fuscescens* Klotzsch. Professor Setchell's plant would then according to this view be a true *Sphaerosoma* and rather closely related to the type species.

The suggestion that the Maine plant might be a *Boudiera* and possibly *B. areolata* Cooke & Phill.[7] together with the fact that this eastern plant was found to have spores almost identical with my own *Sphaerosoma echinulatum* from Iowa, has prompted a more thorough investigation of the character of the European *Boudiera areolata*. Fortunately, I have been able to examine a specimen of this species collected in North Wales and which is apparently a part of the type. To my surprise I find that the mature spores of this species are strongly echinulate and so far as I am able to judge identical with Thaxter's plant and my own, although it is possible that the areolae are a little less distinct in the Iowa plant than in the other two. In the original description of *Sphaerosoma echinulatum* the following note was appended referring to the spores: "Microscopic examination shows on the surface in addition to the spines markings which resemble reticulations, but these are short and not continuous and are not seen at the periphery of the spore, so that they are probably only spines bent so as to give this appearance." From this it will be seen that the semi-reticulate character of the spores was noted in the Iowa plants, although possibly misinterpreted. The spores of the three plants examined might be described at maturity as echino-reticulate with a strong emphasis on the "echini." The spores in both the Iowa and the European plant, however, show a variety of changes in the course of their development. The very young spore is smooth later becoming slightly roughened, the roughenings in the partly matured spore often taking the form of reticulations, the ridges becoming more pronounced about the periphery of the spore until at maturity they appear echinulate with the spines connected by the broken and interrupted ridges mentioned above. The intermediate forms were not seen in the Maine plant for lack of material. All at maturity are pale yellowish-brown.

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[5] Corda, Icones Fung. **6**: 52. *pl. 11, f. 100.* 1854.

[6] Bull. Acad. Sci. Cracovie **1909**: 76–95. 1909.

[7] Grevillea **6**: 76. 1877.

From the above observations it is evident that we have three plants with spores which are, so far as I am able to determine, identical, *i. e., Boudiera areolata* Cooke & Phill., *Sphaerosoma echinulatum* of the writer and the unnamed plant collected by Dr. Thaxter in Maine. From the gross characters, however, I would not suspect that Dr. Thaxter's plant is the same as my own. The plants in the former are smaller, subturbinate, with the hymenium convex and asci strongly protruding. In the latter the plants are larger, flattened below, with the hymenium forming almost a complete semi-circle and the protruding asci not evident, although it is possible that this latter character might have been overlooked in the Iowa plants. When we take into consideration the fact that only five plants were collected in Maine and several hundred in Iowa, it is possible that these apparent differences in gross characters might fade out if the eastern plant could be collected in larger quantity.

Dr. Thaxter's plants accord more closely with early illustrations of *Boudiera areolata* Cooke & Phill. than do my own. However, after studying part of the type of *B. areolata* the writer is convinced that *Sphaerosoma echinulatum* is only an American form of *Boudiera areolata* of European authors. That this is a European species is evident from the fact that the species has been collected twice in Europe since its description from Iowa material, but each time it has been referred to the name given to the American plant with no suggestion that it had been previously described in Europe. The illustration of *Boudiera areolata* by Boudier[8] fits *Sphaerosoma echinulatum* so far as gross characters and color are concerned. The section, however, shows the hymenium as occupying the upper surface only and in this it does not agree with the *S. echinulatum.* This sketch, however, may be diagrammatic.

The habitats of three collections also show a striking similarity. The European plant was originally collected by William Phillips in North Wales and was said to grow on moist ground on the margin of a lake. The habitat of the Maine plant was given by the collector as follows: " It was growing on bare clay mud, where cattle had stamped around a small pond which dries up in midsummer." Dr. Thaxter states that although the original locality has been visited many times since the original collection was made, no more of the plants could be found. My own plants were collected in a pasture at the foot of two small ravines in a depression which is wet a good part of the year. Here cattle had tramped about until the ground was very uneven with standing water in the low places. The plants grew on the bare clayey soil about the margin and on the elevated portions which were very wet. The type locality has been visited only once since the original collection was made in 1904. The latter visit was during the summer of 1912. A special search was made for the plant at this time. The season did not appear to be favorable, but a few immature plants were found, so that I have reason to believe that the species occurs in that locality regularly when the conditions are favorable. At the time of the original collection, two other discomycetes were found growing in company with it, *Ascobolus viridis* and *Lamprospora Crec'hqueraultii.* Both of these plants were found to be present at the time of the last visit.

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[8] Boudier, Ic. Myc. *pl. 417.* 1909.

The genus *Boudiera* was founded by Cooke on *Boudiera areolata.* The genus was placed in the Ascobolaceae apparently on account of the protruding asci, a character which was thought to be restricted to the Ascobolaceae, and in fact one of the characters on which the family is segregated. This character is common to a number of the Pezizaceae, including members of the genus *Lamprospora,* as has been previously noted. The fact that *Boudiera* is often described as having violet spores and is made to include plants of a coprophilous habitat is likely to be misleading, since the type species shows neither of these characters.

If the genus *Boudiera* as represented by the type species is to be retained as a separate genus, it must be regarded as a close relative of *Lamprospora* on the one hand and as showing at least a superficial resemblance to *Sphaerosoma* on the other. Whether this superficial resemblance is an indication of close natural relationship remains to be seen. This resemblance was noted by

Cooke[9] when he stated in referring to *Boudiera,* "in some respects allied also to *Sphaerosoma.*"

Several of the points raised in the present paper are purposely left open with the hope that additional material collected in the field will help to settle some of the questions which are here only suggested.

CONCLUSIONS

The spores of *Sphaerosoma fuscescens* Klotzsch, type of the genus *Sphaerosoma,* are reticulate and not echinulate as concluded by Professor Setchell. *Ruhlandiella hesperia* Setchell is then a true *Sphaerosoma* and closely resembles the type species.

Sphaerosoma echinulatum Seaver is a plant closely resembling *Boudiera areolata* Cooke & Phill. and is probably only an American form of that species and not a true *Sphaerosoma* at all.

Boudiera as represented by *B. areolata* is a genus closely allied to *Lamprospora* on the one hand and showing at least a superficial resemblance to *Sphaerosoma* on the other, a fact which was noted by Cooke, the author of the genus. Whether this resemblance is any indication of natural relationship is a question.

The unnamed plant collected by Dr. Thaxter in Maine, although showing some differences in gross characters, closely resembles in microscopic details *Sphaerosoma echinulatum* of the writer and both are, so far as I can determine, identical in spore characters with *Boudiera areolata* of European authors. Whether the apparent differences in gross characters are of specific importance can be determined only by the collection and study of more abundant field material.

EXPLANATION OF PLATE CXXIII

Spores and paraphyses drawn with the aid of the camera lucida to a common scale and with the same combination of lenses used in drawings of *Lamprospora* spores, MYCOLOGIA **6**: *pl. 114.*

1–4. *Boudiera* sp. from plant collected by Thaxter in Maine, 1, plant about natural size; 2, plant × 7; 3–4, ascus with spores and paraphysis × 450.

5–6. *Boudiera areolata* Cooke & Phill.; 5, partially matured spore; 6, ascus with mature spores × 450. Drawn from material collected in North Wales and apparently a part of the type.

7–10. *Sphaerosoma echinolatum* Seaver; 7, young spore; 8, partially matured spore; 9 and 10, ascus with spores and paraphysis × 450. Drawn from type.

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[9] Grevillea 7: 57. 1878.